

Abridgment

New Location Patterns and U.S. Transportation Policy

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During the next 20 years, geographic shifts of jobs and residences from the central cities to the suburbs, from larger to smaller metropolitan areas, and from the Northeast to the sunbelt cities of the West and South are expected to continue. Potentially, these changes might aggravate or mitigate particular U.S. transportation problems and thus influence the policies designed to solve them. Furthermore, U.S. transportation policies might be called on to arrest or slow the central-city-to-suburb and regional shifts in population that are viewed by many analysts as having undesirable consequences.

Neither of these potential impacts are likely to be realized. The impact of expected location changes on transportation problems in the near future is likely to be relatively modest, so that the response of transportation policy should be correspondingly small. Future transportation policy will be molded principally in reaction to other developments, such as rising per capita incomes. Moreover, transportation policy should not be used to control or arrest these new trends. Whether such control is socially desirable is questionable. However, transportation policy would be ineffective because it has only very limited leverage over the residential and business location decisions that underlie the migration of population.

IMPACT OF EXPECTED LOCATION PATTERNS

Public policy toward transportation is usually formulated in reaction to important underlying trends in traveler or shipper behavior. Consequently, the expected new location patterns will be important in shaping policy only if they have a major impact on trends in urban passenger, intercity freight, or intercity passenger transportation markets.

Urban Passenger Transportation

Two important travel trends have influenced postwar urban transportation policy: (a) the rise in automobile ownership and use and (b) the decline in patronage on public transit systems. The two key factors that will continue to encourage the growth of automobile travel over that of any form of mass transit are rising real incomes and shifts in the locations of residences and employment. The steady increase in real incomes during the postwar period is thought to be the single most important explanation of the decline of transit and the rise of automobiles. During the period from 1947 to 1975, real incomes per household grew by a remarkable 88 percent. As incomes grow, people are willing and able to pay for those amenities more commonly associated with the automobile than public transportation. Especially important are the door-to-door convenience, instant availability, and faster speeds that conserve traveler time. Moreover, rising incomes affect public transportation operators adversely by increasing the wages necessary to attract drivers and other qualified personnel. Public transportation costs are more sensitive to wage increases than are the costs of

automobile use, because public transportation drivers must be paid and most automobile drivers do not consider driving a burden.

The change in the location of residences and employment, and specifically the higher rates of population and employment growth in the suburbs than in the central cities and in the South and Southwest than in the Northeast, is a less important cause of the shift from transit to automobiles. These shifts are caused by a variety of complex factors, including growth in real income (which encouraged the purchase of larger and newer homes—most commonly and more cheaply found in the suburbs) and changes in production technology (such as the one-story plant) and in transportation systems (the development of the truck and the postwar construction of highways). Whatever the causes, the movement of residences and jobs from the central cities to the suburbs has contributed to the shift from public transportation to the automobile because conventional mass transit is not well suited for serving people who live and work in dispersed locations. Also, the suburbs, smaller metropolitan areas, and sunbelt cities generally have newer and more extensive highway systems with lower levels of congestion that further encourage automobile use.

Intercity Freight Transportation

Postwar intercity freight policy has been preoccupied in large measure by the poor financial performance of the railroad industry. During the postwar period the rate of return on capital earned by the railroad industry has been lower than that of most other industries. In recent years, the industry's return has been below 3 percent, less than one-third the average for all of private industry.

Rising per capita income has been, and probably will continue to be, the major reason for both the modest growth in intercity freight and freight carried by railroads. Freight grows more slowly than the gross national product (GNP) because, as per capita incomes rise, a declining share of total income goes to pay for goods with high raw materials and durable manufactured goods. Instead, an increasing proportion of the GNP is used for services that require few material inputs. Moreover, the weight and raw material inputs per dollar value of manufactured goods decline because rising per capita incomes generate improvements in the quality, design, and variety, but generally not weight, of these products.

Rising per capita incomes and the resulting changes in the types of commodities produced and shipped play key roles in the decline in the railroads' share of the intercity freight market. Railroads are at a disadvantage in competing with trucks for highly manufactured traffic because the shippers of such high-valued goods generally require frequent, fast, and reliable service that is more commonly associated with trucks. Moreover, the railroads have had a difficult time competing for bulk commodities; the major growth in bulk commodity movements in the postwar

period has been petroleum shipments, for which pipelines are often better suited.

The movement of manufacturing and other plants from central city to suburban locations is only a secondary reason for the railroads' declining share of the traffic. The shift to the suburbs by employers is caused by a variety of factors, including increasing wage rates (which makes the substitution of floor space for labor more attractive), shift of residences from the central city to the suburbs, and highway construction (which makes suburban locations accessible to trucks). But whatever the causes, suburban plants tend to use trucks rather than railroads because suburban highways are less congested and the plants are usually far from major railroad yards, which tend to be located in the inner city.

Intercity Passenger Travel

The postwar trends in intercity passenger travel that have received the most attention from the federal transportation policymakers are the steady increase in the total volume of intercity travel and changes in the shares of passengers carried by the principal intercity modes. In the postwar period, total domestic intercity passenger kilometers grew at an average annual rate of 4.1 percent. Equally significant, the automobile continued to be the dominant intercity passenger mode (especially for shorter-length trips): Between 1950 and 1973, the automobile's share of intercity passenger kilometers remained reasonably steady (87 percent). Airlines have largely replaced railroads and, to a lesser extent, buses as carriers of the balance of intercity passenger traffic.

Many of the factors that caused the recent rapid growth in intercity passenger travel in general and automobile and air travel in particular are long standing and likely to continue. The single most important factor accounting for the rapid postwar growth in passenger travel has been the growth in per capita income. Households with higher incomes tend to make many more person trips. Population growth has also played an important, though secondary, role in past travel growth; it accounted for perhaps one-seventh of the total postwar increase in travel. Finally, travel growth was also encouraged by substantial reductions in intercity travel times and travel costs. These reductions were particularly large for airlines, automobiles, and buses and due primarily to postwar highway construction and technological developments in aircraft, such as the introduction of pressurized cabins and jets.

Rising per capita income is also probably the single most important factor in the automobile's continued dominance of intercity travel, because higher incomes make the automobile's door-to-door service and instant availability more valuable and affordable. Improvements in intercity highways during the postwar years also helped the automobile by increasing intercity speeds. Finally, the relatively rapid growth of suburban areas contributed to automobile use by ensuring that the origins and destinations of increasing numbers of intercity trips were distant from center-city train and bus stations.

The recent rapid growth in airline travel is also due in part to postwar increases in per capita income; this factor increased the value people placed on the higher speed and convenience offered by air service, especially for longer trips. Airline use was also significantly encouraged by major technological improvements to aircraft, which greatly improved travel speeds and reduced capital and operating expenses.

The recent location trends will not affect the growth

in intercity travel and the dominance of automobile and air travel significantly. Moreover, any small effect they do have will be to reinforce the existing travel trends. The dispersal of population to smaller metropolitan areas may well require that persons make more intercity trips for business, shopping, and recreational purposes. Most of this new traffic would likely be carried by automobile or airlines rather than by the railroads. The population movement to the West and South might also decrease intercity travel somewhat in the Northeast Corridor and thus contribute to slight additional losses of railroad passenger traffic and to slower growth of airline traffic in Northeast airports, which tend to be more congested and more affected by noise problems.

TRANSPORTATION POLICY AND EFFECTS ON LOCATION TRENDS

In the past, transportation policy has been viewed largely as a means of solving problems within the transportation sector. Increasingly, however, policymakers have been tempted to use transportation policy to try to correct nontransportation problems, including some of the recent location trends. The particular location trends that are most often suggested as appropriate targets for transportation policy are the migration of people and jobs from larger to smaller metropolitan areas and, especially, from the central cities to the suburbs of the larger metropolitan areas.

Reorienting transportation policy in an attempt to encourage growth of large metropolitan areas and central cities is probably undesirable, if only because the current range of transportation policies appears to be relatively ineffective in determining the rates of actual city and suburban growth. Many policy analysts find this hard to believe because historically transportation changes are thought to have been the single most important factor in shaping the general patterns of metropolitan development and regional growth. It is important to keep in mind, however, that these past transportation developments, widely credited with shaping central-city and suburban growth, represented enormous changes in the transportation technologies, costs, and accessibility of their times. As a result, accessibility is extremely high in major metropolitan areas—one can travel between any two points in most metropolitan areas very rapidly, often within 20 or 30 min, even during rush hour. More significantly, the range of transportation policies currently being contemplated by U.S. policymakers would not change the general levels of accessibility and transportation costs nearly as much as past developments did. Many current transportation policies, such as the regulation of new-car emissions, fuel economy, and safety standards, change the out-of-pocket costs of travel only modestly and leave travel speeds virtually unaffected. Even public policies or projects that are widely regarded as having a major impact on accessibility, such as the construction of a new freeway or a new rail transit line, usually alter travel costs and times for only a fraction of the metropolitan population—those who live or work close to the facility and choose to use it. Because the range of transportation policies currently being considered does not have nearly the effect on accessibility as past transportation developments, the impact of current policies on the shape of metropolitan development should be proportionately less.

The impact of transportation policy in shaping central-city and suburban growth rates is further weakened by the importance of nontransportation considerations in determining household- and business-

location decisions. The effects of changes in these nontransportation factors may offset or swamp the effects of transportation policy. Factors other than transportation that are significant in residential location choices include levels of real per capita income, public services (especially education), crime rates, and the racial composition of neighborhoods. The steady post-war growth in real per capita income is thought to have played an especially significant role in encouraging residential suburbanization. As per capita incomes grow, households usually purchase more and better-quality housing services; this, in turn, encourages households to locate in the suburbs where lots (which are considered by many to be an important quality improvement) are cheaper because land prices are lower and where newer (and thus often higher-quality) housing tends to be located. Thus, the effects of a future transportation policy designed to discourage residential suburbanization would be offset in part, if not entirely, by the continued rise in real per capita incomes.

The nontransportation factors that influence business-

location decisions are probably more numerous (and more poorly understood) than those that influence residential changes. Rising wage rates and consequent changes in production technologies, for example, are thought to have been important factors in suburbanizing the location of businesses. As per capita income and wage rates increased, it became profitable for manufacturers to substitute capital for labor by using production lines and one-story plants; these new plants were space extensive, situated in suburban locations, built where land was cheap, and proved to be generally advantageous to employers and employees. Improvements in communication technologies may have also encouraged suburbanization of employment by making it more possible to locate central office, clerical, manufacturing, and other functions of a single firm on separate sites.

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Development of Truck Trip-Generation Rates by Generalized Land-Use Categories

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One method of truck trip-generation analysis—that is, the relation between the number of truck trips produced in or attracted to an area and the characteristics of that area—is land-area trip-rate analysis. This technique develops truck trip rates, usually on a per acre or per square mile basis, for each of the various land-use types in a study area. This study reviews previous research on land-area truck trip rates and develops additional land-area truck trip rates for several case-study cities. Use of these rates may prove valuable in the analysis of the impact of major truck generating activities in localized sections of an urban area. An examination of the developed truck trip rates shows that, in general, commercial and industrial land uses are the largest generators of truck trips. Much variation is apparent, however; only residential land uses exhibit any consistency when the results of this research and previously reported truck trip rates are compared.

Trip-generation analysis techniques are usually grouped into one of three categories (1):

1. Multiple-regression analysis, the most widely used of the three procedures, relates zonal trip ends to various socioeconomic and demographic characteristics of a traffic analysis zone through a mathematical modeling procedure.
2. Cross-classification, or category analysis, stratifies independent variables into several distinct groups creating an n -dimensional matrix. For example, averages of the dependent variable and trips per dwelling unit are then computed for each cell of the matrix and forecasts are made by summing the trip ends for the forecast proportions of the independent variables.
3. Land-area trip-rate analysis attempts to develop trip-generation rates—for example, trips per acre—for the various land-use categories existing in the study

area. (Because data compiled for the four case-study cities discussed later in this paper were all in customary units, no SI equivalents are given either in the text or in the accompanying tables.)

The applications of each of these approaches to truck trip-generation analysis are varied but certain techniques have been more widely used than others. Cross-classification analysis, for instance, has had limited use as a truck trip-generation analysis procedure. Although some early work was reported in the Puget Sound Regional Transportation Study (2) and more recent federal guidelines have suggested a modified cross-classification approach for nonresidential trips (3), few specific applications have been made.

Multiple-regression analysis, in contrast, has had widespread use in truck trip-generation analysis. Typical examples of developed regression relations for urban truck trips are shown in Table 1 (4, 5). This table indicates that the earlier equations were often quite complex and involved a variety of independent variables, some with possible high intercorrelations. The Richmond example, however, reflects the continuing trend toward simplification through the use of only one equation for all inter-urban trucks and a limited number of independent variables.

The third approach to truck trip-generation analysis has been the development of truck trip rates, usually truck trip ends per acre, for the general land-use types existing in an urban area. Application of these developed land-area truck trip rates rests not so much in long-range strategic planning on a regionwide, urban, or even networkwide basis, but rather in the short-run tactical